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Use of an app as a complementary strategy to speech-language therapy in a case of cognitive-communication disorder

O uso de aplicativo como estratégia complementar na terapia fonoaudiológica em um caso de distúrbio cognitivo da comunicação

ABSTRACT

With the aging of the population, there is an increase in the incidence of common diseases to this age group, such as dementias. Efforts to improve the quality of health care for these patients, including speech-language therapy, have grown. This study aims to evaluate the effectiveness and applicability of the Talk Around It as a complementary strategy in the language therapy of a patient with cognitive communication disorder. The participant was evaluated before and after speech therapy through standardized language assessment protocols. The main focus of therapy was the reduction of anomies. The Talk Around It application has been selected as a complementary therapeutic resource to achieve this goal. In the post-therapy evaluation improvement or maintenance of the Montreal-Toulouse Battery for Language Assessment-Brazil Battery subtests scores was observed: Oral naming (nouns, verbs and total), Semantic and Orthographic verbal fluency and Oral narrative discourse (information unit and scenes). Functional assessment of communicative skills has not changed consistently after the intervention. The technological resource used with conventional therapeutic strategies, during three months, led to improvements in the lexical access ability in the case studied. It use in clinical practice in patients with mild dementia has proved possible.

RESUMO

Com o crescimento da população idosa, evidencia-se um aumento da incidência de doenças comuns a essa faixa etária, como as demências. Esforços para aprimorar a qualidade dos cuidados em saúde a esses pacientes, incluindo os cuidados fonoaudiológicos, têm crescido. Este estudo objetiva avaliar a efetividade e a aplicabilidade do aplicativo Talk Around It como estratégia complementar na terapia fonoaudiológica em um caso de distúrbio cognitivo da comunicação. O participante foi avaliado pré e pós-terapia fonoaudiológica por meio de protocolos padronizados de avaliação da linguagem. A terapia teve como foco principal a redução de anomias. O aplicativo Talk Around It foi selecionado como recurso terapêutico complementar para alcançar esse objetivo. Na avaliação pós-terapia observou-se melhora ou manutenção dos escores dos subtestes da Bateria Montreal-Toulouse de Avaliação da Linguagem-Brasil: Nomeação oral (substantivos, verbos e total), Fluência verbal semântica e ortográfica e Discurso narrativo oral (unidade de informação e cenas). A avaliação funcional das habilidades comunicativas não se modificou de modo consistente após a intervenção O recurso tecnológico empregado com estratégias terapêuticas convencionais, durante três meses, conduziu a melhoras da habilidade de acesso lexical no caso estudado. Seu uso na prática clínica em pacientes com demência em fase leve mostrou-se possível..

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INTRODUCTION

The growth in the elderly population has been accompanied by an increase in diseases common in this age group, such as dementia. Alzheimer´s disease (AD) is the most prevalent of the dementias, affecting 5% of all individuals aged over 65 years[1]. Given AD is the most prevalent diagnosed form of dementia, there is extensive knowledge on the language disorders associated with the condition.

Patients with AD present cognitive-linguistic and behavioral symptoms which worsen during the disease course[1]. The initial phase is characterized by memory, behavioral and personality changes, whereas communication impairments manifest in poor, vague and circumlocutory spontaneous speech, anomia onset and an inability to produce word lists. In the moderate phase, deficits in memory and learning are increased and communication becomes disorganized with difficulty maintaining coherent discourse. Anomia is frequent at this stage, and difficulties solving problems and making judgements emerge. The final phase is characterized by loss of autonomy and independence, while communication deteriorates with echolalia, perseverations and mutism[2].

In a recently proposed classification for oral language disorders in adults and older people, dementia can lead to a variety of conditions affecting communication, such as cognitive-communication disorder (CCD)[3]. CCD or disturbances stem from, or are associated with, deficits in other cognitive functions[4], such as memory, attention and executive functions, which influence language processing[3] and have a major impact on level of discourse and social exchanges[4]. In these conditions, the aim of speech-therapy interventions is to improve social and family interactions, alleviating and compensating for the language impairment. The positive results of cognitive interventions seen in these cases are attributed to neuroplasticity associated with changes in brain activity and functional connectivity[5].

Among the resources used for rehabilitation of language disturbances, there has been a rise in the use of technological resources, such as apps. Use of apps has increased in many different areas of speech-therapy practice, such as language development in children and voice, including the rehabilitation of intensive care patients, in an effort to promote alternative communication[6]. However, few studies have investigated the use of complementary technologies, such as computers, software and apps, for the rehabilitation of dementia patients[7-9], where investigations to date largely center on AD patients[8-10].

One such study investigated the use of the *Remember* app in Brazilian Portuguese, designed for aiding older adults with AD by addressing everyday problems in a playful fashion and stimulating cognitive functions, particularly memory[8]. *Alz memory* is a mobile app, also available in Brazilian Portuguese, used as a non-pharmacological aid in older adults with AD to train memory and attenuate the effects of the disease[9]. Most other apps available are only in English and contain tasks which address memory problems but lack user interaction[8].

Talk Around It is one of the few apps specifically designed for patients with dementia and focuses on language as opposed to memory. The app centers on lexical-semantic aspects of verbal language production and contains naming exercises. The use of this app is indicated for enhancing naming, memorization and communication abilities to improve the autonomy of AD patients.

A large contingent of the population now has access to technology, such as digital networks, including older people, albeit to a lesser degree[11]. Access to these technologies, and familiarity with their use, enables speech-language therapists to exploit these resources in the process of rehabilitating patients with communication problems, such as older patients with early stage dementia.

The objective of the present study was to assess the effectiveness and applicability of the *Talk Around It* app as a complementary strategy to speech-language therapy (SLT) in a case of CCD.

CLINICAL CASE PRESENTATION

A prospective single-case study was conducted. Pursuant to the regulations governing research involving humans in Brazil, this study was approved by the Ethics Committee for Research of the institution heading the study, under permit no. 2.044.338. All participants signed the Free and Informed Consent Form, thereby agreeing to the conducting of the study and publication of its results.

The participant in the present study was a 74-year-old man with 8 years´ education and a nursing home resident for 8 years. The patient was diagnosed with CCD, characterized by semantic-lexical and emissive and receptive pragmatic deficits. He had a score of 20 on the Mini-Mental State Examination with losses on the items temporal orientation, calculus, language (written) and recall. The patient was clinically diagnosed with early stage dementia (CDR= 01 mild) of unspecified type and had been in use of Donepezil 10mg for 9 months.

The patient had a history of peripheral vascular, arterial and venous insufficiency and systemic arterial hypertension. He had a stroke 10 years prior, leading to right hemiparesis, with no other apparent sequela at the time. Current complaints include being unable to utter some words and to read, and memory loss for recent events. The patient had corrected visual acuity deficits, but no other current or previous diagnoses of neurological or psychiatric condition or hearing loss. He previously engaged in reading and writing, activities which became more restricted in recent years.

Although not having regular contact with next of kin, he was well-adapted to the nursing home. He had good social interactions with the other nursing home residents and professionals and took part in routine activities. He was receiving physiotherapy and had been part of the cognitive stimulation group for 4 years, aimed at maintaining cognitive functions to minimize the losses associated with progression of dementia.

The participant was a regular user of the both computer and mobile phone devices, even prior to institutionalization, representing a prerequisite criterion for inclusion in the study.

The participant underwent assessment before, and immediately after, a SLT program with a neurocognitive approach. The speech-therapy evaluation of pre and post-therapy semantic-lexical verbal expression was performed according to the following protocol: naming, semantic and orthographic verbal fluency,

and oral narrative discourse subtests of the Montreal-Toulouse Language Assessment Battery (MTL-Brasil) and the Boston Naming Test (BNT). Communication-related functional capacity was assessed by applying the American Speech-Language-Hearing Association Functional Assessment of Communication Skills for Adults (ASHA-FACS) scale to both the participant and a caregiver from the nursing home recommended by the team. Results were compared using descriptive statistics to analyze the effectiveness and applicability of the use of the app in the SLT.

The speech-therapy program entailed a total of 13 weekly 50-min sessions (Chart 1). The objective of the SLT was to ameliorate anomia. To this end, the *Talk Around It* (*Neuro Hero*) was employed as a complementary strategy to SLT. The full version of the app was installed on a mobile device running the Android system.

The app included exercises for word-finding (naming) and contained 108 items. The app provides the user with written and audio prompts. In addition, the program checks patient

Charts 1. SLT Programme for reducing anomia

Therapy Sessions	Talk Around It App	Therapeutic lexical access strategies	Generalization strategies for discourse
1st	Naming (10 items)*+	_____	Producing sentences (10 items)
2nd	Naming (30 items) +	_____	Producing sentences (8 items)
3rd	Naming (30 items) +	_____	Producing sentences (10 items)
4th	Naming (30 items) +	_____	Producing sentences (10 items)
5th	Naming (30 items)+	_____	Producing sentences (10 items)
6th	Training (10 items)*	Naming of semantic category figures (rooms in home, places, professions, parts of body, colors and shapes), presented in order, with presentation of semantic, phonologic and/or orthographic prompts, if needed (30 items)	Producing sentences (10 items)
7th	Training (10 items)*	Naming of semantic category figures (places, professions, parts of body, colors and shapes), presented in order, with presentation of semantic, phonologic and/or orthographic prompts, if needed (30 items)	Producing shared stories (5 stories, 2 items per story)
8th	Training (10 items)*	Naming of semantic category figures (places, professions, parts of body, shapes and feelings), presented in random order, with presentation of semantic, phonologic and/or orthographic prompts, if needed (20 items) - Semantic categorization and naming of figures (categories: colors and parts of body), with presentation of semantic prompts, if needed (10 items).	Producing shared stories (5 stories, 2 items per story)
9th	Training (10 items)*	- Complete sentences with gaps orally, with visual prompts (figures), if needed (10 items)	Producing shared stories (3 stories, 4 items per story)
10th	Independent use (27 items)	- Semantic categorization and naming of figures (categories: shapes and rooms in home), with presentation of semantic prompts, if needed (10 items).	_____
11th	Independent use (27 items)	- Identification, from set of 3 figures, of item not belonging to semantic category, followed by naming of items (5 sets of 3), with presentation of semantic and phonologic prompts, if needed (15 items) - Naming from semantic prompts (cue questions), with orthographic and phonologic prompts, if needed (20 items)	Producing shared stories (2 stories, 4 items per story)
12th	Independent use (27 items)	- Identification, from set of 3 figures, of item not belonging to semantic category, followed by naming of items (5 sets of 3), with presentation of semantic and phonologic prompts, if needed (15 items) - Naming from semantic prompts (cue questions), with orthographic and phonologic prompts, if needed (20 items)	Producing shared stories (2 stories, 4 items per story)
13th	Independent use (27 items)	- Semantic categorization and naming of figures (categories: animals and objects), with presentation of semantic and orthographic prompts, if needed (29 items). - Identification of elements not belonging to scene, with presentation of semantic and phonologic prompts, if needed (9 items).	Producing shared stories (4 items)

*Use of test version of App; +Semantic, phonologic and/or orthographic prompts available on app, in the event of anomia or errors

progress by displaying test results on graphs. The items from the app were presented visually to the participant, who then had to name them. During the first 5 sessions, in the event of anomia or errors, the prompts provided by the app were given (semantic, phonological and orthographic).

In the subsequent 4 sessions, the participant was trained on the use of the mobile device and app. After this training period, the resource was made available to the participant for independent use during the final 4 weeks. During these stages the app was used with the test option set, in which prompts are not provided. The test option was elected for this stage of the therapy program for allowing results to be recorded. The participant was asked to use the app exercises at least 3 times a week over the 4-week period. A caregiver from the team was instructed on the use of the app in order to oversee and assist the participant if needed in the event of a query or doubt.

The performance of the participant on the MTL-Brasil Battery is shown in Table 1.

On the BNT, the patient correctly recalled, spontaneously, 41/60 items on the pre-therapy assessment and 44/60 on the post-therapy assessment. The expected performance for the patient's age and education was a score of 23[12].

The results on the ASHA-FACS scale, pre and post-therapy, are shown in Table 2.

Analysis of the patent's naming performance specifically using Talk Around It revealed 90%, 70%, 70%, 67% and 83% correct responses for the first 5 sessions, respectively. A total of 130 stimuli were presented during these sessions. For all items in which anomia occurred (35), except four, the patient was assisted by a prompt to help perform normal lexical access. The semantic prompts proved the most helpful (17/31 correct responses).

In the training sessions for independent use of the app, the patient attained 100% correct responses during the 4 sessions. During the four weeks of independent use of the app, the frequency of use ranged from 2 to 5 times a week (mean= 3 times a week). Mean performance for the four sessions was 98%, 100%, 95%, 100% correct responses, respectively.

With regard to the generalization effect of the lexical access ability, on the strategy for producing sentences using the target words from the app, the patient had only 2 anomia events out of the 50 words selected over the course of the 5 sessions. Regarding generalization of naming for untrained items, a higher rate of anomias was observed during the sessions in which conventional therapeutic strategies for improving lexical access were employed (Table 3).

Table 1. Performance of participant on MTL-Brasil Battery tasks pre and post-SLT

MTL-Brasil Subtests	Total/Cutoff Score	Pre-therapy Score	Post-therapy Score	Post-Pre-therapy difference
Oral naming (12 nouns)	24 / 21.5	21	22*	1
Oral naming (3 verbs)	6 / 6	4	6*	2
Oral naming (total)	30 / 26.4	25	28*	3
Semantic verbal fluency	NA / 10.2	9	10	1
Orthographic verbal fluency	NA / 6.6	2	2	0
Oral narrative discourse (words)	NA / 15.9	39*	28*	-11
Oral narrative discourse (information units)	10 / 2.5	5*	5*	0
Oral narrative discourse (scenes)	3 / 1	1	2*	1

*Scores above expected cut-off for age and education
Caption: NA: Not Applicable

Table 2. Performance on ASHA-FACS scale, pre and post-SLT, as rated by patient and caregiver

ASHA-FACS domains (number of items)	Total/Mean expected Score	Patient			Caregiver		
		Pre-therapy	Post-therapy	Post – Pre-therapy difference	Pre-therapy	Post-therapy	Post – Pre-therapy difference
Social Communication (21)	7/6.6	6.7*	7*	0.3	7*	6.8*	-0.2
Communication of Basic Needs (7)	7/6.4	7*	7*	0	7*	7*	0
Reading, Writing and Number Concepts (10)	7/5.9	6.5*	6*	-0.5	4.5	5	0.5
Daily Planning (5)	7/5.6	7*	5.8*	-1.2	5.3	5	-0.3
Mean total of general independence in communication	7/5.9	6.8*	6.4*	-0.4	5.9	5.9	0

*Above-normal scores

Table 3. Performance of participant on naming tasks without use of app during SLT

Sessions	Anomia rate (%) by strategy	Correct response with prompt
6th session	Naming: 15/30 (50%)	Semantic: 11
		Phonologic: 4
7th session	Naming: 15/30 (50%)	Semantic: 11
		Phonologic: 3
		Spontaneous Recovery: 1
8th session	Naming: 12/20 (60%)	Semantic: 10
		Phonologic: 1
		Spontaneous Recovery: 1 Semantic: 1
	Naming and categorization: 1/10 (10%)	
9th session	Complete sentences: 3/10 (30%)	Semantic: 2
		Visual Aid: 1
10th session	Naming and categorization: 1/10 (10%)	Phonologic: 1
11th session	Identification, from 3 x figures, of item not belonging to semantic category: 3/15 (20%)	Semantic: 3
	Naming using semantic prompts (cue questions): 1/20 (5%)	
		Phonologic: 1
12th session	Identification, from 3 x figures, of item not belonging to semantic category: 1/15 (6.6%)	Semantic: 1
	Naming using semantic prompts (cue questions) 3/20 (15%)	
		Semantic: 2
		Spontaneous Recovery: 1
13th session	Naming and categorization: 2/29 (6,8%)	Semantic: 2
	Identification of elements not belonging to scene: 0/9 (0%)	

DISCUSSION

On the pre-therapy evaluation using the MTL-Brazil Battery, the patient had below-expected scores on the subtests of verbal naming (nouns, verbs and total scores), semantic verbal fluency and orthographic verbal fluency. On the post-therapy assessment for the same subtests, scores were higher across all tasks except the orthographic verbal fluency subtest. Scores on this test remained unchanged and much lower than expected, suggesting greater difficulty at the phonological level and impairment of executive functions.

The performance improvement in fluency with semantic criteria can be explained by the fact that specific semantic (but not phonological) strategies were included in the therapeutic program applied. In a study of 2 patients with AD, the efficacy of semantic feature training for the treatment of anomia was investigated and found to improve naming ability[13]. A recent systematic review on non-pharmacological interventions conducted in Brazil identified the semantic-lexical approach as one of the most effective for language and communication rehabilitation in patients with AD[14].

On the verbal narrative discourse subtest, although a higher number of words were produced at the first assessment, the discourse produced on the post-therapy assessment was more succinct, but more coherent and cohesive. The increase in the scenes score on this subtest after therapy corroborates this observation, since this measure assesses the patient's ability to perceive key elements of the scene, i.e. the patient included elements of the linguistic macrostructure in his discourse, rendering it more coherent.

Analysis of communication-related functional capacity showed that the ASHA-FACS domains whose scores were above normal level for all stages and according to both respondents (patient and caregiver elected by nursing home team) were: social communication and communication of basic needs. Comparison of patient and caregiver responses showed the patient rated his communication abilities higher than the caregiver, perhaps due to a reduced perception of own difficulties, often observed in dementia cases. Results on the ASHA-FACS scale show that the patient's communication difficulties occurred at more specific levels of language, involving the domains of daily planning, reading, writing and number concepts.

The patient was interested, participative and engaged throughout the therapeutic process, despite reports by the nursing home team of mood swings and inflexibility. Regarding the 5 therapy sessions involving use of the app, the number of anomia events was lower on the first session. This finding may be explained by the use of the free version of the app, which contains fewer items. Additionally, the higher frequency of occurrence of these lexical items in the language may also have contributed to the improved performance seen. In the other 4 sessions, the full version of the app was used and the number of anomia events remained the same, with an improvement in performance on the last session.

The patient's performance when using the app during the training and independent use phases was higher compared to

the first 5 sessions of therapy. The greater performance during the training session may have been due to memorizing of items, given the 10 items from the free version were trained. There are several theories potentially explaining the performance improvement seen during independent use of the app, namely: greater familiarity with the app, longer time in use, gains from the parallel conventional therapy sessions or the effectiveness of the app itself. Scientific evidence of the positive effects of semantic-lexical therapy in dementia cases supports the last two theories[13,14].

In a North American study, the use of the MossTalk Words app (indicated for treatment of naming difficulties) was investigated in a patient with semantic dementia[15]. The therapy programme applied was based on the errorless learning approach. The authors reported gains in the patient´s naming ability after a 3-month period of therapy using the app. Another study, involving application of a computer-based programme of assorted language exercises in 5 patients with mild-to-moderate AD, found preservation or slight gains in patients´ linguistic competence over a 12-month period[10].

Given that the app was used as a complementary strategy to SLT, the data on participant performance for the conventional therapeutic strategies must also be taken into account. Results show the number of anomia events was greater during the first 3 sessions which employed the conventional strategies. During the course of the subsequent sessions, the occurrence of anomia events reduced considerably. Improved performance as the sessions progressed suggests the intervention programme applied had a positive effect in the case studied, mirroring results of other cognitive intervention programmes in pathological aging, where these gains that can be explained by neuroplasticity of the brain[5].

It is important to note that the stimuli used during the sessions with conventional strategies were from different semantic categories than those used in the Talk Around It app. The poorer initial performance in naming using the new stimuli compared to the app stimuli (sessions 6, 7 and 8), suggests that generalization of gains promoted by the app did not occur for untrained items.

Semantic prompts proved the most beneficial for the patient in the therapeutic strategies, derived from the app or otherwise. The improved performance with the aid of semantic prompts can be explained by the semantic-lexical deficit observed in dementia[13-15].

Despite the favorable results reported, the present study has several limitations which should be mentioned. Only a single case was investigated, without the use of a control or longitudinal follow-up after therapy. Notwithstanding the generalization of results, the preliminary data found warrant further studies to provide more consistent evidence on the use of technology as an adjunct to the SLT recommended for individuals with CCD.

FINAL COMMENTS

The technological resources, employed together with conventional strategies for 3 months, promoted improvement in lexical access ability in the case studied. These results suggest the use of the Talk Around It app in clinical practice for patients with mild dementia is feasible, although further studies should be conducted to confirm these findings.

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Author contributions